

Low NOx Fuel-Flex Combustor

Completed Technology Project (2013 - 2019)



Project Introduction

Reduce Nitrous Oxide (NOx) emissions from fuel-flexible combustors to 80% below the Committee on Aviation Environmental Protection (CAEP)/6 standard with minimal impacts on weight, noise, or component life.

Anticipated Benefits

Reduce aircraft emissions at both ground level (80% below the CAEP6 LTO NOx standard) and cruise conditions to reduce the impact of aircraft operations on both local air quality and the environment (TRL3 by end of FY19).

Primary U.S. Work Locations and Key Partners



Low NOx Fuel-Flex Combustor

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Organizational Responsibility	1
Project Transitions	2
Project Website:	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	2
Target Destination	2

Organizational Responsibility

Responsible Mission Directorate:

Aeronautics Research Mission Directorate (ARMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Advanced Air Vehicles

Low NOx Fuel-Flex Combustor

Completed Technology Project (2013 - 2019)



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
● Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California
United Technologies Research Center	Supporting Organization	Industry	
Woodward	Supporting Organization	Industry	

Project Transitions

**October 2013:** Project Start**September 2019:** Closed out

Closeout Summary: Combustion and emissions testing of United Technologies Research Center's (UTRC's) small core combustor in NASA GRC's CE-5 flametube test facility comprising of LTO and cruise conditions has been completed. Sufficient NOx emissions data was collected to formulate correlation equations for assessing reductions in NOx for LTO against CAEP/6 and cruise against 2005 best-in-class. Back-to-back testing of Jet-A fuel and a 50/50 blend of Jet-A with an alternative fuel demonstrated a measurable effect of fuel composition on non-volatile particulate matter emissions. Post-test analysis indicates LTO NOx emissions >80% below CAEP6 in UTRC single-sector tests of small-core N+3 combustor.

Documentation describing N+3 combustor concept selected, design approach, initial flametube test & analysis results; and preferred concept recommended for higher fidelity research has also been completed. This Lean Burn combustor concept shows potential to meet/exceed NASA's Far Term LTO NOX reduction goals, but further investigation of dynamic characteristics of the combustor concept are required to ensure good operability over the entire flight regime conditions.

Project Website:

<https://www.nasa.gov/aeroresearch/programs/aavp/aatt>

Project Management

Program Director:

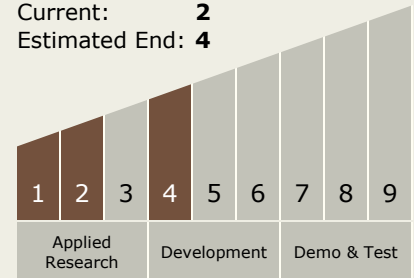
James A Kenyon

Project Manager:

James D Heidmann

Technology Maturity (TRL)

Start: **1**
 Current: **2**
 Estimated End: **4**



Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.3 Aero Propulsion
 - └ TX01.3.1 Integrated Systems and Ancillary Technologies

Other/Cross-cutting:

- TX01 Propulsion Systems
 - └ TX01.3 Aero Propulsion
 - └ TX01.3.12 Alternative Low Carbon Jet Fuel

Target Destination

Earth